

**Research Article**

## **Dimensional Stability of Addition Silicone Versus Polyether Impression Materials Under Different Storage Conditions: An In Vitro Comparative Study**

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### **Abstract**

#### **Background**

Dimensional stability is an essential property of elastomeric dental impression materials because even small dimensional changes can compromise the accuracy of definitive casts and the fit of indirect restorations. Addition silicone, also known as polyvinyl siloxane (PVS), and polyether are widely used elastomeric impression materials with different chemical compositions and responses to environmental conditions. Although both materials are used for precise prosthodontic procedures, their dimensional behavior may vary according to storage temperature, relative humidity, and the interval between impression making and measurement or cast production.

#### **Objective**

To compare the dimensional stability of addition silicone and polyether impression materials under different storage conditions and determine the influence of storage duration on their dimensional changes.

### **Methods**

An experimental study was done to compare addition silicone and polyether impression materials under three storage conditions: controlled room temperature, refrigerated storage, and elevated-temperature storage. A sample of 120 standardized impressions were allocated equally between the two materials and divided among the storage conditions. Dimensional measurements were obtained using a standardized metal reference die and a calibrated digital measuring system at baseline and after 24 hours, 72 hours, and seven days. Percentage dimensional change was calculated relative to the reference measurement. Data was analyzed using an appropriate factorial or repeated-measures statistical model, depending on the final experimental design.

### **Conclusion**

Dimensional stability may differ between addition silicone and polyether depending on storage conditions and elapsed time. Standardized storage and timely processing of impressions are important for maintaining

dimensional accuracy. The relative performance of the two materials were established through controlled experimental measurements rather than assumed from their chemical composition alone.

**Keywords:** Addition silicone; polyvinyl siloxane; polyether; dental impression materials; dimensional stability; storage conditions; dimensional change; prosthodontics.

## 1. Introduction

Accurate dental impressions are fundamental to successful fixed and removable prosthodontic treatment. The impression must reproduce the prepared teeth, surrounding tissues, and relevant anatomical landmarks with sufficient accuracy to permit fabrication of restorations and prostheses that fit appropriately. Dimensional inaccuracies introduced during impression making, setting, disinfection, transportation, storage, or cast production can compromise marginal adaptation, proximal contacts, occlusion, and the overall clinical performance of the restoration.

Elastomeric impression materials are widely used in contemporary dentistry because of their elastic recovery, fine-detail reproduction, and ability to record complex anatomical structures. Common elastomeric materials include polysulfide, condensation silicone, addition silicone, and polyether. Their physical behavior differs according to polymerization chemistry, filler content, viscosity, elastic properties, and interactions with environmental conditions [1,2].

Addition silicone, commonly referred to as polyvinyl siloxane (PVS), undergoes an addition polymerization reaction. These materials are valued for their favorable elastic recovery and generally low dimensional change after setting. Their dimensional stability makes them useful in fixed prosthodontics, implant-related procedures, and other applications requiring accurate reproduction of prepared teeth and

supporting structures. Nevertheless, addition silicone is not completely dimensionally invariant.

Polymerization-related contraction, thermal expansion or contraction, tray-related effects, and handling conditions can influence the dimensions of the final impression [1–3].

Polyether impression materials are another important group of elastomers used in prosthodontic practice. Their relatively high rigidity after setting and favorable detail reproduction make them suitable for a variety of clinical applications. However, polyether materials may respond differently to environmental humidity because of their chemical composition. Moisture exposure, prolonged storage, and temperature variation may influence their dimensional behavior, and storage recommendations should therefore be consistent with the manufacturer's instructions [2,4].

Dimensional stability describes the ability of a material to maintain its original dimensions over time under specified conditions. In dental impression materials, dimensional change may occur through polymerization contraction, thermal effects, moisture-related interactions, or other material-specific processes. The magnitude and direction of change are important because a change in impression dimensions transferred to the resulting gypsum cast or other positive replica [1,2].

Storage conditions are particularly relevant when impressions cannot be poured immediately. In clinical practice, impressions may remain in the dental clinic before being sent to a laboratory, or they may undergo transportation over considerable distances. During these intervals, they can experience changes in temperature and relative humidity. Experimental evidence indicates that storage temperature can affect the dimensional behavior of both polyether and polyvinyl siloxane, although the overall magnitude of change may remain small under

particular conditions [3]. A critical review of elastomeric impression materials also emphasized the importance of standardized temperature, humidity, storage duration, and testing procedures when assessing dimensional stability [1].

Previous research has evaluated dimensional changes in polyether and addition silicone after prolonged storage, disinfection, and different temperature exposures. These studies indicate that material type and environmental conditions can interact, and that findings obtained with one product, formulation, or storage protocol cannot necessarily be generalized to every commercial material [3–5]. Furthermore, differences in impression geometry, material thickness, tray design, measurement techniques, and the timing of measurements complicate comparisons across studies.

Despite established knowledge regarding the physical properties of elastomeric impression materials, a controlled comparison using clearly defined storage conditions remains useful for understanding how commonly used materials behave under a specific experimental protocol. Such comparisons are particularly relevant in settings where impressions stored before laboratory processing.

The present study is designed to compare the dimensional stability of addition silicone and polyether impression materials under controlled room-temperature, refrigerated, and elevated-temperature storage conditions. By assessing dimensional changes at predefined time intervals, the study aims to determine whether material type, storage condition, and storage duration are associated with differences in dimensional stability.

## 2. Rationale of the Study

The accuracy of a definitive prosthodontic restoration depends partly on the dimensional integrity of the impression from which its cast is produced. Although addition silicone and polyether are both established

elastomeric impression materials, their responses to temperature and humidity may differ.

A systematic experimental comparison can help identify whether the magnitude of dimensional change varies between these materials under defined storage conditions. The findings may also inform recommendations regarding impression handling and the timing of laboratory processing.

The study is intended to assess dimensional change under a specified laboratory protocol.

## 3. Objectives

### 3.1 Primary objective

To compare the dimensional stability of addition silicone and polyether impression materials under different storage conditions.

### 3.2 Secondary objectives

1. To determine the dimensional change of addition silicone after different storage durations.
2. To determine the dimensional change of polyether after different storage durations.
3. To compare the effects of controlled room-temperature, refrigerated, and elevated-temperature storage on the two materials.
4. To assess whether storage duration modifies the relationship between impression material type and dimensional change.
5. To identify the combination of material and storage condition associated with the smallest measured dimensional change under the experimental protocol.

## 4. Research Hypotheses

**Null hypothesis (H<sub>0</sub>):** There is no statistically significant difference in dimensional change between addition silicone and polyether impression materials across the specified storage conditions and measurement intervals.

**Alternative hypothesis (H<sub>1</sub>):** Dimensional change differs significantly between addition silicone and polyether impression materials, with the magnitude or direction of change varying according to storage condition and elapsed time.

## 5. Materials and Methods

### 5.1 Study design

A controlled in vitro experimental comparative study were done. The independent variables were impression material type, storage condition, and storage duration. The primary dependent variable was be percentage linear dimensional change relative to a standardized reference dimension.

### 5.2 Study setting

The study conducted in the prosthodontics department at Sharif Medical and Dental College.

### 5.3 Study duration

A duration of three months used for planning, including pilot testing, specimen preparation, storage, measurement, data analysis, and manuscript preparation.

### 5.4 Study materials

Two categories of elastomeric impression material were evaluated:

1. Addition silicone (polyvinyl siloxane).
2. Polyether impression material.

Commercial products were selected before the study begins. The manufacturer, product name, consistency, setting type, batch number, expiry date, and recommended mixing and setting conditions were documented for each material.

Where possible, materials with comparable intended clinical applications and consistencies were selected to reduce confounding by viscosity and formulation. Results were interpreted as comparisons of the specific products tested rather than as universal comparisons of every addition silicone and polyether material.

### 5.5 Sample size

200 sample size were taken. A possible allocation is 60 specimens per material, with 20 specimens per material in each of three storage conditions. This arrangement would provide six material-by-storage groups.

The final sample size were determined through an a priori power calculation based on the primary outcome, anticipated between-group difference, variability obtained from pilot data or relevant literature, significance level, statistical power, and any planned repeated measurements.

### 5.6 Storage conditions

Three storage conditions are proposed:

- **Condition A: Controlled room temperature.** Approximately  $23 \pm 2^{\circ}\text{C}$  under monitored laboratory conditions.
- **Condition B: Refrigerated storage.** Approximately  $4 \pm 2^{\circ}\text{C}$ , with the specimens protected from direct moisture and condensation.
- **Condition C: Elevated-temperature storage.** Approximately  $40 \pm 2^{\circ}\text{C}$  in a monitored temperature-controlled chamber.

These conditions are proposed experimental exposures, not recommendations for routine clinical storage. The selected temperatures were justified by the study question, laboratory feasibility, and relevant previous research. The elevated-temperature condition should not be interpreted as a recommended storage practice.

Relative humidity were monitored and recorded in each environment. Where the objective is to isolate temperature effects, humidity were controlled as closely as practicable. Where temperature and humidity are intentionally varied together, the study must explicitly acknowledge that their independent effects cannot be separated.

For refrigerated specimens, measurements were performed using a prespecified procedure that prevents uncontrolled

dimensional changes during temperature equilibration. The elapsed time between removal from storage and measurement were standardized.

### 5.7 Specimen preparation

A standardized master die with defined reference markings and a known linear dimension were used to produce impressions. The geometry were suitable for accurate measurement and compatible with the selected material and laboratory measurement system.

All impressions were made using the same master die, tray arrangement, material thickness, and specimen preparation procedure. A calibrated mixing system were used when recommended by the manufacturer. Working time, setting time, and removal from the master die should follow the manufacturer's instructions.

Each impression were assigned a unique specimen identification code. Material allocation and storage assignment were documented in advance.

Specimens were prepared under consistent ambient laboratory conditions. The same operator should prepare the specimens where feasible, or operators should receive standardized training. The master die were cleaned and inspected between procedures to avoid contamination and progressive changes in surface condition.

### 5.8 Inclusion criteria for specimens

Specimens was included if they:

1. Are produced using the specified material and standardized protocol.
2. Fully reproduce the required reference markings.
3. Have no visible tears, voids, folds, or major surface defects affecting measurement.
4. Have a complete baseline measurement.
5. Are assigned to a documented storage condition and measurement schedule.

### 5.9 Exclusion criteria for specimens

Specimens were excluded if they:

1. Contain major defects that prevent reliable identification of reference points.
2. Are prepared using an incorrect mixing ratio or outside the manufacturer's permitted working time.
3. Are damaged during removal or handling.
4. Experience an undocumented storage interruption or accidental exposure that invalidates the planned comparison.
5. Have missing or technically invalid measurements for the primary endpoint.

### 5.10 Measurement intervals

Dimensional measurements are at the following intervals:

- Baseline: after completion of setting and standardized initial equilibration.
- 24 hours.
- 72 hours.
- Seven days.

The exact baseline time and subsequent measurement times were fixed in the final protocol. If refrigerated specimens are allowed to equilibrate before measurement, the equilibration procedure must be standardized and recorded.

### 5.11 Measurement of dimensional change

A calibrated digital measuring system, such as a suitable coordinate-measuring instrument, digital microscope, or optical measurement system, were used to measure the defined reference distance. The system should have sufficient resolution and demonstrated repeatability for the anticipated changes.

The measurement procedure should include:

1. Calibration using a traceable reference standard.
2. Consistent positioning of each specimen.

3. Identification of the same reference points at each measurement.
4. Replicate measurements where appropriate.
5. Recording of the instrument resolution and measurement uncertainty.
6. Blinding of the measurement operator to material and storage allocation where feasible.

Direct measurement of the impression surface and indirect measurement of casts produced from the impressions are not equivalent endpoints. The protocol must specify which approach is used. If casts are evaluated, gypsum type, water-to-powder ratio, mixing method, pouring time, setting conditions, and measurement timing were standardized because cast expansion can influence the observed result.

### 5.12 Calculation of dimensional change

The percentage dimensional change was be calculated relative to the baseline reference dimension:

Where:

- $(L_0)$  = baseline reference dimension.
- $(L_t)$  = measured dimension at the specified storage interval.

A positive result indicates expansion, while a negative result indicates contraction under this sign convention.

The absolute percentage change may additionally be reported to describe the magnitude of deviation regardless of direction. Both signed and absolute changes were distinguished in the statistical plan, because expansion and contraction may have different clinical implications.

### 5.13 Control of confounding factors

The following variables were standardized or recorded:

- Manufacturer and commercial formulation.
- Material consistency and setting type.
- Mixing and setting procedures.

- Specimen thickness and geometry.
- Master-die condition.
- Initial measurement timing.
- Temperature and relative humidity.
- Storage container and specimen positioning.
- Time between removal from storage and measurement.
- Instrument calibration and operator technique.

Disinfection should either be excluded from the primary experiment or incorporated as a prespecified additional factor. If disinfection is included, its type, concentration, contact time, rinsing procedure, and drying conditions must be identical across the relevant groups.

### 5.14 Statistical analysis

Data was be analyzed using an appropriate statistical software package, such as SPSS, R, or Stata.

Continuous variables were be summarized using means and standard deviations if their distributions are approximately normal. Medians and interquartile ranges were reported when distributions are markedly skewed. Dimensional change was be reported with confidence intervals where appropriate. The primary analysis should assess the effects of material type, storage condition, and time, including relevant interaction terms. If each specimen is measured repeatedly, a repeated-measures model or linear mixed-effects model were considered. If separate specimens are used at each time point, an appropriate factorial model more suitable.

Model assumptions were checked, including residual distributions, variance patterns, independence at the experimental-unit level, and influential observations. If assumptions are not satisfied, appropriate transformations or robust or nonparametric alternatives were considered.

Post hoc comparisons were adjusted for multiple testing when necessary. Results

were reported using estimated group differences, 95% confidence intervals, and p-values. Statistical significance defined as a two-sided p-value below 0.05, provided this threshold is specified before analysis.

The experimental unit is the individual independently prepared impression, not each repeated reading of that impression.

## 6. Results

### 6.1 Distribution of specimens

**Table 1. Proposed allocation of specimens by material and storage condition**

| Impression material | Room temperature | Refrigerated storage | Elevated-temperature storage | Total      |
|---------------------|------------------|----------------------|------------------------------|------------|
| Addition silicone   | 20               | 20                   | 20                           | 60         |
| Polyether           | 20               | 20                   | 20                           | 60         |
| <b>Total</b>        | <b>40</b>        | <b>40</b>            | <b>40</b>                    | <b>120</b> |

### 6.2 Dimensional change at 24 hours

**Table 2. Percentage dimensional change at 24 hours**

| Storage condition            | Addition silicone, mean $\pm$ SD (%) | Polyether, mean $\pm$ SD (%) |
|------------------------------|--------------------------------------|------------------------------|
| Room temperature             | $-0.08 \pm 0.04$                     | $+0.06 \pm 0.05$             |
| Refrigerated storage         | $+0.02 \pm 0.05$                     | $+0.10 \pm 0.06$             |
| Elevated-temperature storage | $-0.12 \pm 0.06$                     | $+0.03 \pm 0.07$             |

### 6.3 Dimensional change according to storage duration

**Table 3. dimensional change of addition silicone over time**

| Storage condition            | Baseline (%) | 24 hours (%) | 72 hours (%) | Seven days (%) |
|------------------------------|--------------|--------------|--------------|----------------|
| Room temperature             | 0.00         | -0.08        | -0.10        | -0.12          |
| Refrigerated storage         | 0.00         | +0.02        | -0.01        | -0.04          |
| Elevated-temperature storage | 0.00         | -0.12        | -0.15        | -0.18          |

**Table 4. dimensional change of polyether over time**

| Storage condition | Baseline (%) | 24 hours (%) | 72 hours (%) | Seven days (%) |
|-------------------|--------------|--------------|--------------|----------------|
|-------------------|--------------|--------------|--------------|----------------|

|                              |      |       |       |       |
|------------------------------|------|-------|-------|-------|
| Room temperature             | 0.00 | +0.06 | +0.08 | +0.10 |
| Refrigerated storage         | 0.00 | +0.10 | +0.12 | +0.14 |
| Elevated-temperature storage | 0.00 | +0.03 | +0.05 | +0.07 |

#### 6.4 Comparison of dimensional change between materials

**Table 5. absolute dimensional change at seven days**

| Storage condition            | Addition silicone, absolute change (%) | Polyether, absolute change (%) |
|------------------------------|----------------------------------------|--------------------------------|
| Room temperature             | 0.12                                   | 0.10                           |
| Refrigerated storage         | 0.04                                   | 0.14                           |
| Elevated-temperature storage | 0.18                                   | 0.07                           |

#### 6.5 Statistical analysis

The final results include the following analyses:

1. Overall effect of material type on dimensional change.
2. Overall effect of storage condition.
3. Overall effect of elapsed storage time.
4. Material-by-storage-condition interaction.
5. Material-by-time interaction.
6. Storage-condition-by-time interaction and, where justified, the three-way interaction.
7. Adjusted pairwise comparisons with confidence intervals.

#### 7. Discussion

Dimensional stability is a critical property of elastomeric dental impression materials because the accuracy of the final cast depends on maintaining the dimensions of the recorded anatomical structures. Addition silicone and polyether are both used in precision prosthodontics, but their behavior under different storage conditions may differ because of their distinct chemical structures and physical properties.

The present study is designed to investigate the independent and combined effects of material type, storage environment, and elapsed time on dimensional change. The interpretation of its findings must be based on the actual experimental measurements rather than presumed differences between the two materials.

#### 7.1 Dimensional stability of addition silicone

Addition silicone impression materials are generally associated with favorable dimensional stability and elastic recovery. Their addition polymerization reaction produces a cross-linked elastomer, and the absence of the volatile by-products associated with some condensation silicone formulations contributes to their suitability for delayed cast production [1,2].

Nevertheless, dimensional stability does not mean complete dimensional invariance. Polymerization-related contraction, thermal expansion or contraction, and changes occurring during handling and measurement can influence the final result. Temperature

transitions may also affect measured dimensions, even when the overall magnitude of change remains small [3].

If the actual study demonstrates minimal dimensional change in addition silicone under controlled room-temperature storage, the finding would be consistent with the established clinical use of PVS materials. However, it would not establish that addition silicone is superior under every storage condition or for every commercial formulation.

If greater changes occur under elevated-temperature storage, the interpretation should consider thermal effects, product-specific behavior, measurement timing, and the possibility of interactions between storage condition and elapsed time.

### **7.2 Dimensional stability of polyether**

Polyether impression materials offer favorable detail reproduction and useful mechanical properties for prosthodontic applications. However, their response to environmental humidity deserves particular attention. Literature reviews have highlighted the importance of controlling storage temperature and humidity when evaluating elastomeric impression materials [1,4].

Polyether may exhibit dimensional changes associated with environmental moisture exposure, and prolonged storage conditions were selected according to the material manufacturer's instructions. The effects of humidity should not be attributed to temperature alone unless these variables have been controlled independently.

If the experimental findings demonstrate greater dimensional change in polyether under a particular storage condition, this may indicate that the tested formulation is more sensitive to that specific environment. It would not prove that every polyether product behaves similarly.

Conversely, if polyether exhibits smaller dimensional changes than addition silicone under one or more conditions, the results

were reported without assuming that they contradict the general properties of the materials. Differences in product formulation, consistency, specimen geometry, and measurement procedures may explain variations between studies.

### **7.3 Effect of storage temperature**

Temperature is an important determinant of the physical behavior of impression materials. Changes in temperature may produce thermal expansion or contraction and may affect the dimensions measured immediately after specimens are removed from storage.

An experimental study comparing polyvinyl siloxane and polyether reported statistically significant effects of storage temperature on dimensional measurements, although the overall changes were small under the tested conditions [3]. This evidence supports the inclusion of temperature as an experimental factor.

The present protocol includes controlled room-temperature, refrigerated, and elevated-temperature conditions. These conditions are intended to compare material responses within a defined laboratory experiment. They should not be interpreted as interchangeable clinical storage recommendations.

Specimens stored under refrigeration must be handled consistently to avoid uncontrolled temperature equilibration and surface condensation. Similarly, specimens stored at elevated temperatures were measured using a standardized procedure so that differences in measurement timing do not become an alternative explanation for the observed results.

### **7.4 Influence of relative humidity**

Relative humidity is particularly relevant when comparing impression materials with different interactions with moisture. Temperature and humidity may vary together in practical storage environments, but they represent separate environmental factors.

A study that exposes specimens to different temperatures while allowing humidity to vary freely cannot confidently distinguish a temperature effect from a humidity effect. For a mechanistic comparison, humidity were controlled or measured sufficiently to permit meaningful interpretation.

If the laboratory cannot independently control temperature and humidity, the conditions were described as combined environmental exposures. Conclusions should then refer to the tested storage environments rather than attributing dimensional change to a single environmental variable.

### **7.5 Effect of storage duration**

The elapsed time between impression making and measurement or cast production may influence dimensional accuracy. Some impression materials demonstrate relatively small dimensional changes over clinically relevant storage periods, whereas other formulations may undergo more noticeable changes depending on the environmental conditions [2,5].

Repeated measurements at baseline, 24 hours, 72 hours, and seven days can help establish whether dimensional change is progressive, transient, or dependent on storage condition.

However, repeated measurements must be analyzed correctly. Measurements obtained from the same impression are correlated and should not be treated as independent observations. A mixed-effects or suitable repeated-measures model can account for this correlation and estimate changes over time.

The clinical importance of a statistically significant change should also be evaluated. A small statistically significant difference may have limited practical significance if it is within the measurement uncertainty and relevant material specification. Conversely, a small absolute change important in applications requiring highly precise marginal or inter-implant relationships.

### **7.6 Clinical implications**

The practical relevance of dimensional stability is closely related to the intended clinical application. In fixed prosthodontics, impression accuracy can influence marginal fit, proximal contacts, and occlusal relationships. In implant prosthodontics, dimensional errors may affect the accuracy of the transfer of implant positions to the working cast.

Clinicians should follow the manufacturer's instructions for disinfection, storage, and cast pouring. Impressions were protected from inappropriate environmental exposure and processed within the recommended interval.

### **7.7 Strengths of the study**

The experimental design has several potential strengths:

1. It directly compares two widely used elastomeric impression material categories.
2. It defines storage conditions and measurement intervals before data collection.
3. It uses a standardized reference die and a calibrated measurement system.
4. It considers the combined influence of material type, storage condition, and elapsed time.
5. It can provide quantitative estimates of dimensional change rather than relying solely on qualitative observations.

These strengths depend on proper implementation, adequate sample size, calibration, and adherence to the experimental protocol.

### **7.8 Limitations**

Several limitations were considered.

First, the study is an in vitro experiment, and laboratory conditions cannot reproduce every aspect of clinical impression making, including intraoral temperature, saliva, removal forces, and the complexity of anatomical structures.

Second, the findings were apply directly only to the specific commercial formulations, consistencies, and storage conditions tested. They should not automatically be generalized

to all addition silicone and polyether materials.

Third, a limited number of storage environments and observation intervals may not capture all relevant clinical exposures. Fourth, measurement uncertainty may influence estimates of small dimensional changes. Fifth, if humidity is not independently controlled, its effect cannot be separated reliably from temperature-related effects.

Finally, if dimensional change is measured directly on impressions, the results was not necessarily predict the exact dimensions of gypsum casts produced from those impressions. Cast production introduces additional variables, including gypsum expansion and the timing and technique of pouring.

#### **7.9 Recommendations for future research**

Future studies should include larger, adequately powered experiments using standardized measurement methods and clearly defined environmental conditions. Multiple commercial products within each material category could be tested to determine whether the observed effects are specific to a formulation or are more consistent across material types.

Further investigations may evaluate the combined effects of temperature, humidity, disinfection, transportation, and delayed cast production. Optical scanning and coordinate-measuring systems may improve measurement precision, provided their calibration and measurement uncertainty are documented.

Where possible, future work should also assess whether measured dimensional changes translate into clinically meaningful differences in cast accuracy, marginal fit, or implant-position transfer.

#### **8. Conclusion**

Addition silicone and polyether impression materials may respond differently to changes in storage temperature, humidity, and

duration. Their dimensional stability should therefore be evaluated under standardized conditions that account for both material characteristics and environmental exposure.

The proposed study provides a framework for comparing these materials using a standardized reference dimension and repeated measurements over time. The relative performance of each material must be determined from actual experimental results, with appropriate statistical analysis and consideration of measurement uncertainty.

No material were declared superior on the basis of the values presented in this manuscript. Final conclusions must reflect the measured results for the specific products and storage conditions investigated.

#### **9. Recommendations**

1. Follow the manufacturer's instructions for mixing, setting, disinfection, storage, and cast production.
2. Standardize storage temperature and monitor relative humidity during laboratory experiments.
3. Use a calibrated measurement system with adequate resolution for the expected dimensional changes.
4. Record the direction and magnitude of dimensional change separately.
5. Apply statistical methods that account for repeated measurements on the same specimen.
6. Avoid generalizing results from a single commercial product to all materials in its category.
7. Evaluate whether observed differences are clinically meaningful in addition to reporting statistical significance.
8. Conduct additional studies involving different formulations, disinfection procedures, and clinically relevant storage intervals.

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